

# Translation of P1203 PCT

(04-0781)

German Patent

Document No. WO 98/42988

## PROCESS FOR ANCHORING CONNECTING ELEMENTS IN A MATERIAL WITH PORES OR CAVITIES AS WELL AS CONNECTING ELEMENTS THEREFOR

[Verfahren zum Verankerung von Verbindungselementen in einem  
Material mit Poren oder Hohlräumen sowie Verbindungselemente  
für die Verankerung]

UNITED STATES PATENT AND TRADEMARK OFFICE

Washington, D.C.

December 2003

Translated by: Schreiber Translations, Inc.

Country : Germany  
Document No. : WO 98/42988  
Document Type : Patent Application  
Language : German  
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IPC : WO 98/42988  
Application Date : Mar 19, 1998  
Publication Date : Oct 1, 1998  
Foreign Language Title : Verfahren zum verankerung von  
                          Verbindungselementen in einem  
                          Material mit Poren oder Hohlräumen  
                          sowie Verbindungselemente fuer die  
                          Verankerung  
English Title : Process For Anchoring Connecting  
                          Elements In a Material With Pores  
                          or Cavities as well as Connecting  
                          Elements Therefor

**PROCESS FOR ANCHORING CONNECTING ELEMENTS IN A MATERIAL WITH  
PORES OR CAVITIES AS WELL AS CONNECTING ELEMENTS THEREFOR**

The invention concerns a process according to the preamble of the first independent patent claim. The process is used to anchor connecting elements in materials made of porous material or cavities, particularly in wood or material similar to wood (for example, chipboards). Furthermore, the invention concerns connecting elements to be used in the process. According to the invention process, the anchored connecting elements are used especially for fabrication of constructs consisting of various parts or for fastening of fittings.

According to the state of the art technology, the parts of wood or wood-like materials, for example, are linked together with connecting elements in form of nails and screws in that they are driven through one of the parts being connected into the other part to be connected. In most cases, screws and nails are made of metal. At the surface area of one of the parts being connected is a head and they are anchored in at least one other part to be connected to it by a friction or an interlocking form-

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<sup>1</sup> Numbers in the margin indicate pagination in the foreign text.

fit. In a wood construction, these pin type connecting elements represent a manifold corrosion susceptible foreign bodies which,

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can become troublesome in further processing after connecting of the parts, and which represent heat transport bridges to the finished construction.

It is also known, that parts of fibrous materials, to which group the wood and wood-like materials belong, are connected with parts of thermoplastic synthetic materials in that the thermoplastic synthetic material is plasticized on the surface facing the part of fibrous material and both surfaces are pressed together.

Additionally, the synthetic material is attached in a plasticized form to the surface of the fibrous material or it is plasticized in the final position, for example, by ultrasonic input. At the boundary layer between the synthetic and fibrous materials all these processes a connection is created in the sense of a microscopic form closure in that the plasticized synthetic material is pressed into the uneven surface of the fibrous materials. Such methods are described, for example in the publications FR-2455502, FR-1495999, DE-3828340, or EP-0269476. According to WO-96/01377, the synthetic material part can also be a peg which connects two wooden parts together. Other known methods for connecting parts of wood or wood-like materials are

based on the same principle in which, a layer of thermoplastic synthetic material, for example, a layer of lacquer is brought between the parts to be connected and the parts are then pressed together using ultrasonic input (JP-52127937 and WO-96/01377).

In all the above-described processes, synthetic and fibrous materials are connected together by a microscopic form closure conditioned surface adhesion as it occurs in the same way with the standard gluing processes. The named process then also

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have some of the same varied disadvantages, especially the sensitivity to thermal stresses and stresses caused by moisture in which both of the surfaces connected together stretch out unevenly and result in substantial sheering forces which weaken the connection or may even destroy it.

The invention has set for itself the goal to demonstrate anchoring of connecting elements, for example, of connecting pins in parts of one material with pores or cavities, especially parts made of wood or wood-like materials, wherein the process is based on the above named process for connecting synthetic materials and wood parts and wherein its disadvantages are at least reduced, that means, it especially delivers anchoring which is more stable under thermal stresses and/or stress caused by moisture. The

process is to be simple and, nevertheless, be specific as to connecting elements with various functions and various material types and be adaptable to various materials. Further, the process is to be feasible to be carried out with common materials and tools and will little effort.

This task will be solved by a process as defined in the patent claims.

According to the process outlined in the invention for anchoring plasticized synthetic material not pressed only into the uneven surfaces, as is done in the known processes, but into the pores or cavities inside the parts in which the connecting element is to be anchored so that it forms a macroscopic anchor. This macroscopic anchoring is based on penetration of the plasticized synthetic materials into microscopic pores

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of the material and on creating a type of a composite consisting of the originally porous material and the penetrated synthetic material or on a macroscopic form closure created when the plasticized synthetic material is pressed into the macroscopic cavities.

According to the process outlined in the invention, an opening with a closed end, for example, a borehole (a threaded hole) is created in the part in which the connecting element is to be anchored. The connecting element which will consist completely or partially of thermoplastic synthetic material will be positioned in this borehole.

The borehole and the connecting element are in their form adjusted to each other to the extent that the connecting element can be inserted up to the first position of the bore without the use of force and that, when it is driven from this first position further against the closed end of the bore into the second, final position, at least at the predetermined anchor position between the connecting element and the bore wall, with the help of a pressure force parallel to the bore axis, pressure builds up here while at the other positions no pressure is created.

At the same time with the pressing in of the connecting element from the first to its second position in the bore or immediately before that, energy is introduced to the connecting element in such a way that the synthetic material in the above described predetermined anchoring positions on which the pressure is concentrated, is locally plasticized. Such directed local plasticization can, for example, be achieved,

- in that the connecting element consists completely of a thermoplastic synthetic material or, has at least the surface areas of thermoplastic synthetic material in the areas intended for anchoring and in that such connecting element acts upon supply of energy with ultrasonic or another suitable vibration, wherein at the places of the pressure concentration (intended anchoring positions) the strongest friction and thus the greatest heat is generated and thus the thermoplastic synthetic material becomes plasticized (related to connecting techniques such as ultrasonic welding, friction welding, vibration welding, orbital welding);
- in that the connecting element in the areas of intended anchoring positions has at least the surface areas from a thermoplastic synthetic material that can be more easily plasticized at lower temperatures than other materials of the connecting element and in that such connecting element is heated by heat supply;
- in that the connecting elements in the areas of intended anchoring positions has at least the surface areas from a thermoplastic synthetic material in that the metal particles are

embedded and in that such connecting element is heated by induction.

The connecting element has at least the first predetermined anchoring position on its inner side which, in the closed borehole, is directed against the closed end of the bore. Furthermore, the connecting element has, on its opposite external side, that is projecting from the bore or positioned in the bore opening side a thickening serving as a head or as means for fastening

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another part or it has another anchoring position at an intervals from the external side of the first anchoring position. It is especially the pin type connection elements with several intended anchoring positions that can be taken into consideration.

While the connecting element is pressed into the second, final position in the bore, and while at the same time it is supplied by energy, the material at the predetermined anchoring positions at which the high pressure between the connecting element and the bore wall plasticizes the connecting element material and, under the pressure at these positions, the bore wall or, as the case may be, it is pressed into the pores or cavities in the material

that is adjacent to the bore, and it remains unchanged at other locations.

So that the plasticized synthetic material is pressed into the bore wall by the pressure generated at the anchoring positions, it must have porosity or openings to the cavities or the bore wall must be constituted in such way that the plasticized material can be pressed into the arising pressure pores or cavities. Porous materials which are suitable for anchoring according to the invention-designed process are especially wood or wood-like materials, but also sandstones, ceramic materials, bricks, or concrete, etc. Cavities suitable for the creation of anchoring according to the invention, open up essentially diagonally to the bore axis and are found especially in light construction elements.

The achievable depth of the anchoring of a synthetic material in a porous material is dependent on its structure (for wood, for example, on density of the wood fibers), but also on the pressure used and the

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locally available amount of plasticized synthetic material. As remains to be shown, for example, massive wood anchoring depth of 1 to 4 cm is easily achievable.

The desirable depth of the synthetic material anchoring in a porous material is dependent on the material load carrying capacity and can be controlled by the amount of material to be pressed in and/or by the force of the pressure used. The type of anchoring can be largely controlled by the appropriate tuning of the type of drilling and the type of a connecting element. Thus, the anchoring can be prepared according to the invention process, which is very specifically fitted to the character of the material (i.e. type of wood, orientation of wood grain or the density gradient relative to the direction of the bore, etc.) in which the anchoring is to be prepared and on the function and load which the contacting element is to bear.

For a specific use of the most advantageous forms of a bore and connecting element as well as the height of the press force and the amount of energy to be supplied to the connecting element is to be determined in each specific case experimentally.

The process for anchoring and connecting elements in a part from a porous material, especially from wood or wood-like material or a material with suitable cavities and various types of connecting elements according to the invention will be described in the following figures in more detail. They show:

**Figure 1** an exemplary process alternative for anchoring of a connecting pin with a head in a wood part to connect two parts of wood;

**Figure 2** an additional exemplary process alternative for anchoring of a connecting pin in two parts of wood to be connected.

**Figure 3 to 5** three exemplary process alternatives of an anchoring position in the area of the closed bore end;

**Figure 6** example of a fitting which, with the help of a majority of the connecting pins anchored in one wooden part is attached to this part;

**Figure 7** yet another exemplary process alternative for anchoring a connecting element which comprises an internal screw thread for fastening of additional parts;

**Figure 8** an example of an anchoring in a light construction element with cavities according to the invention.

All figures represent connecting elements, drilling, and anchoring in a section along the bore axis.

According to the invention, **Figure 1** shows as the first and exemplary alternative the process of anchoring a pin type

connecting element with a head (connecting pin 3.1) in a first wooden part 1 for connecting this first part 1 with a second part 2.1 which, in a way of example, is also made of wood.

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The connecting pin 3.1 shows in the area of its inner end a predetermined first anchoring position 31 and on its outer end a head 32. The bore 4.1 which passes completely through the part 2.1 and in the part 1 has a closed end 41, it is less deep than the connecting pin 3.1 is long and, for example, has at its open end a extended depression for counter sinking the head 32. The cross section of the bore 4.1 is matched to the cross section of the connecting pin 3.1 to the extent that the pin can be guided all the way to a closed end 41 of the bore without much effort. This is the first position of the connecting pin 3.1 in the bore 4.1.

From the first position, the connecting pin 3.1 is arranged with a pressing force F, which is essentially parallel to the bore axis and presses further into the bore 4.1. The only place at which a pressure is created by the pressing force F between the connecting pin 3.1 and the side of the bore 4.1 is in the area of the closed bore end 41. If the already described manner of support is provided through the supply of energy to the connecting pin, it is arranged that during the forcing in at this

point, the material is plasticized only at this position and only at that location will the anchoring 10 of the connecting pin take place in the part 1 to be connected.

This anchoring 10 is represented in the Figure as a synthetic material area but it actually consists of an inner mix of wood fibers and synthetic material that is the same as a composite material and it can, for example, be done with a spruce, with its texture parallel to the bore axis and with a depth of 2 cm.

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The length of the connecting pin 3.1, the depth of the bore 4.1, the force F, and the amount of energy being supplied are to be attuned to such a degree that the anchoring meets the desired conditions of firmness and that both of the parts between the head 32 of the connecting pin and the anchoring 10 are firmly teamed up.

The connecting pin 3.1 of the Figure 1, is anchored in part 1 through the anchoring position 10, which is only possible when one part is from porous material, especially wood or wood-like material, or when the material of the bore wall in area of the anchoring position has suitable cavities or if such openings are created by the pressure exercised on the connecting pin in the bore wall.

As shown, the part 2.1 as show here, can consist of wood but also from another nonporous material (metal or synthetic material). The head 32, as it is shown in Figure 1, can be a component of the connecting pin. But the head can also be placed on the connecting pin after the preparation of the anchoring, for example, screwed into a designated screw thread. The head 32 can be of a given type, for example, also represented as a metal fitting with a specific function.

An advantage of connecting two parts, as shown in Figure 1, against other connecting processes in which plasticized synthetic materials are used as connecting material, consists in that it can be prevented in every case that the plasticized material is pressed into the joint between the connecting parts 1 and 2.1 and thus push them away from each other. This is prevented

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in that no pressure is created in the area of such joint and the material of the connecting pin in this area is not plasticized. If the energy to the connecting pin is being supplied in the form of ultrasonic waves, the connecting pin 3.1, as represented in the area of its inner end to be positioned at the closed bore end 41, it must consist of a thermoplastic synthetic material. The

remainder of the pin can be of the same material or another material.

If the energy being supplied to the connecting pin 3.1 is in the form of heat, it consists in the area of the anchoring position of a synthetic material that is capable of plasticizing at a lower temperatures than the material of which the connecting pin consists in other areas. In such case, it is also entirely thinkable that the connecting pin contains a "soul" of a heat conducting material such as, for example, metal, over which the soul which is the heat being supplied to the connecting pin can be guided against the anchoring position.

If the energy being supplied to the connecting pin inductively the thermoplastic material of the predetermined anchoring position 31 contains embedded metal particles.

**Figure 2** shows as an additional, exemplary alternative, according to the invention process, an anchoring of the pin type connecting element (connecting pin 3.2), for example, in two wooden parts 1 and 2.2 to be connected together,

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whereby the connecting pin 3.2 is anchored in both parts 1 and 2.2 (anchoring 10 and 20).

The connecting pin 3.2 shows how the connecting pin 3.1 of Figure 1, a predetermined first anchoring position 31, is to be inserted in the inner end of the bore. Furthermore, it shows a predetermined second anchoring position 33, which is represented in form of a graduated cross section narrowing and is arranged on the pin where it will be positioned in the second part 2.2 to be connected.

The bore 4.2 shows a cross sectional narrowing on the connecting pin 3.2 corresponding to cross section narrowing 42 on which the connecting pin is placed in its first position. If the connecting pin 3.2 is pressed deeper into the bore 4.2 by the press force F, it results in a pressure not only in the area of the closed end 41 of the bore 4.2 but also in the area of the cross section narrowing 42 through which the plasticized synthetic material is pressed at this place into the inner wall of bore 4.2 and creates a second anchoring 20.

The bores 4.1 and 4.2 in the Figures 1 and 2 have advantageously a round cross section. The connecting pins 3.1 and 3.2 can also be round. But they can also have another cross section fitting into a corresponding bore. For example, the connecting pin 3.2 in the area of its smaller cross section can be round and in the

area of its larger cross section have an angled cross section (i.e. a square) wherein only the areas at the edge are set up on step 42.

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The closed end (41) of the bore is represented flat in both Figures 1 and 2 and the connecting pin sits in the first position with a flat cross cut surface in the bore. With such type of bore and connecting pin an essentially even form pressure builds during the pressing in of the pin over the entire cross cut end.

The plasticized material is mainly parallel to the longitudinal axis of the connecting pin driven into the wood so that the cross section of the anchoring 10 is only a little larger than the cross section of the connecting pin.

Such design of the predetermined first anchoring is advantageous for uses in which the wood grain in the area of the first anchoring 10 is arranged parallel to the bore axis and the wood of the part 1 tends to split already at a slight displacement.

Something of a similar effect can be achieved with a pin having a pointed end that sits in its first position on a something like an equally pointed bore end.

**Figures 3 to 5** show additional advantageous design types for specific uses of predetermined first anchoring positions 31 on, for example, pin type connecting elements 3 and thus cooperating closed ends 41 of bores 4 which, especially with the use of ultrasonic vibration to different types of anchoring (10).

**Figure 3** shows an end of a connecting pin 3 in two variants that are set up on a closed end of a bore 4. In both cases, the pin end is pointed and specifically sharper than the bore end. That

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will concentrically concentrate the arising pressure by forcing the connecting point 3 into the bore 4 wherein the material is pushed increasingly parallel to the pin axis in the part 1 so that here also, the evolving anchoring 10 stretches more in the direction of the axis than crosswise. The firmness of such type of anchoring is based primarily on an enlargement of the shear stressed surfaces in the wood.

**Figure 4** shows the end of a pin 3 which has a concave form. By forcing this pin into a bore with a flat or a pointed closed end, a pressure is building above all in the radial position which creates the anchoring 10, which stretches more crosswise to the pin axis. Such anchoring is suitable primarily for a part 1 in

which the grain runs crosswise to the pin axis, or for anchoring in a chipboard, the surface of which is running crosswise to the pin axis. The firmness of such anchoring is based above all in arising from closure between two wooden parts and connecting pin.

**Figure 5** shows another design of the predetermined first anchor position 31 on a connecting pin 3 and a corresponding bore end 41. Here it is a first anchoring position which is essentially designed the same way as the second anchoring position of the Figure 2. The bore 4 represents a stepwise cross section narrowing 43 on which the pin is positioned in the first position.. If this connecting pin is forced into the borehole, a pressure builds up in the area of the bore end, above all radially, and the plasticized material is forced into the wood mainly crosswise to the pin axis.

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**Figure 6** shows a part 5 made of any desirable material which, with the help of pin type connecting elements 3 which are anchored in a part 1 made of the wood, for example, according to the invention process 6 is attached to this part 1. The part 5 is a mounting (for example a turning joint part), for example made of synthetic material. Both connecting pins 3 are formed on the part 5 or in another suitable way connected to it and are

anchored in the boreholes of the part 1 according to the way it is described. Here also, as already mentioned in connection with Figure 1, with respect to a connecting pin head, the part 5 can have some type of form and after the preparation of the anchoring on the connecting pins 3 or on the connecting pins 3 can be set up in a suitable manner.

**Figure 7** shows the establishment of a connection of a wooden part 1 with a mounting part 6, for example, made of metal, according to the invention, using the anchoring of a connecting element 3.3 in part 1 and fastening of the mounting part 6 on the anchored connecting element 3.3. The connecting element 3.3 represents a two step, first anchoring position 31 and is inserted in a borehole 4.3 in a stepwise narrowing ground. Bore 4.3 and the connecting element 3.3 act under the pressing in of the connecting element into the bore while, at the same time, plasticizing of the anchoring position 31 as it was explained in relation to the Figure 4. A "two step" anchoring 10 is built up in the process.

The connecting element 3.3 of the Figure 7 shows on the opposite located external side of its predetermined anchoring position as the means for fastening another part of the inner screw cutting

34 into which the brace 6 is screwed in after anchoring of the connecting element 3.3 in part 1.

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**Figure 8** shows the result of another, exemplary design form of the process according to the invention, specifically the anchoring of a connecting element 3.4 in one part 1 which is a light construction element with cavities 11. The closed borehole necessary for the process according to the invention, which is inserted into the connecting element 3.4, in this case, is a continuous bore 4.4 through which one of the external layers 1.1 of the part 1 passes. This continuous borehole 4.4 through another element, for example, through an inner layer 1.2 or, as the case may be, through the opposite located external layer 1.3 is closed to the extent that between the continuous borehole 4.4 and the locking element it opens essentially crosswise to the bore axis stretching cavity area 11.1 or through the pressure of the connecting element 3.4 on which the borehole locking element is created, for example, by corresponding deformation of the inner layer 1.2.

The connecting element 3.4 is inserted into bore 4.4 and positioned through the bore closing element (i.e. inner layer 1.2). Then the connecting element 3.4 is pressed against the

bore closing element and, at the same time, the synthetic material in area of this element is plasticized and is present or available in the cavity area 11.1 which is pressed between the external layer 1.1 and the bore closing element, which creates a macroscopic anchoring 10.

The process according to Figure 8 is suitable, as it is represented, especially for uses in light construction where in place of massive materials a thin plate type material is carried through a supporting structure (pointed out through both braces 20) comes to be used. The external

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layers 1.1. and 1.3 here, for example, are thin massive wooden sheets or layered chipboards. Since the borehole 4.4 is a closing element, one of the crossbars 20 can stretch to an adjacent crossbar 20 or across the entire surface of the first layer can be, for example, from synthetic material or metal consisting inner layer 1.2 an integrated or otherwise locally and specifically formed element for this purpose in the cavity 11.

The connecting element 3.4 is, for example, according to Figure 8 suitable for the fastening of mountings on light construction elements.

Thermoplastic materials used in the connecting element have an advantage of high mechanical strength, especially a high tensile strength and a high E-module. Especially suitable are polyamides, polycarbonates and polyester carbonate. For increasing the strength, the synthetic material of a connecting element can also contain glass or carbon fibers. Other thermoplastics suitable for connecting elements are: acrylo-nitrile butadiene styrene, styrene acryl nitrile, poly-methyl metacrylate, polyvinyl chloride, polyethylene, polypropylene, and polystyrene.

An exemplary connecting pin for joining together two wooden parts, as represented in Figure 2 has, for example, the form shown in Figure 2 and is comprised of acryl nitrile butadiene styrene. It has a smaller round cross section at 8 mm diameter and a larger round diameter of 10 mm. It is 60 mm long and has a concentric cross section narrowing down. The corresponding borehole is 40 mm deep and has the cross sectional narrowing of the pin corresponding grade at a 30 mm level. The pin is inserted into the bore and during the 5s with a compression power of 2000N and a ultrasonic

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amplitude of approx. 44  $\mu\text{m}$  forced into the bore. The end of the pin is then even with the wood surface.

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P A T E N T   C L A I M S

1. The anchoring process of a connecting element (3 and 3.1 to 3.4) in one part(1) consisting of a porous material, which has cavities (11.1) or in which pressure cavities can be created, wherein the connecting element is inserted into a borehole (4, and 4.1 to 4.4) with an inner closed end (41) is **characterized in that** the connecting element (3 and 3.1 to 3.4) is located in a first position in the bore and that the connecting element then, essentially parallel to the bore axis oriented pressure force F forces it from the first position into a second one deeper in the borehole whereby the connecting element (3, 3.1 to 3.4) and the bore (4 and 4.1 to 4.4) are become aligned together to the extent that the connecting element can be essentially inserted without use of force in the first position and that pressing it into the second position at at least one predetermined anchoring position (31 or 33) between the connecting element (3 and 3.1 to 3.4) and the wall of the borehole (4 and 4.1 to 4.4)

where pressure is built up, whereby the connecting element at least in the area of the predetermined anchoring position (31 or 33) consists of a thermoplastic synthetic material and whereby, during the forcing of the connecting element into the second position, energy is supplied to the connecting element in such manner that the thermoplastic synthetic material in the area of at least one predetermined anchoring position (31 or 33) is plasticized and by the pressure is forced into the pores or cavities of the part (1) and creates a macroscopic anchoring (10, 20).

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2. Process according to Claim 1 is **characterized in that** at least one predetermined anchoring positions (31) in the area of closed bore end (41) is planned in that the connecting element (3 and 3.1 to 3.4) and the borehole (4 and 4.1 to 4.4) are aligned together to the extent that the connecting element is its first position extends to the closed end of the borehole or is seated on a cross sectional narrowing (43) of the bore in the area of the closed end (41).

3. Process according to Claim 2 is **characterized in that** the connecting element is a connecting pin (3.2) for connecting

the first part (1) with a second part (2.2), is also from a porous material or has cavities, that the borehole (4.2) is drilled through a second part (2) and that another anchoring position (33) is configured in the second part (2.2) so that the bore (4.2) in the second part (2.2) shows a stepwise cross section narrowing (42) and the connecting pin (3.2) has a cross section narrowing (42) has an essentially corresponding shoulder with which it is seated in its first position on the stepwise cross section narrowing (42).

4. Process according to Claim 2 is **characterized in that** the connecting element is a connecting pin (3.1) and that the connection of the fist part (1) with a second part (2.1) the bore (4.1) leads through the second part (2.1) and the connecting pin (3.1) has a head-like enlargement.
5. Process according to Claim 2 is **characterized in that** for connecting a second part (5, 6) with the first part (1), the second part

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(5, 6) is formed as a one piece with the connecting element (3) or is attached to the connecting element (3.3) before or after the anchoring.

6. Process according to one of the claims 1 through 5 is  
**characterized in that** the connecting element (3 and 3.1 to 3.4) is supplied energy by ultrasonic vibration.
7. Process according to one of the claims 1 through 5 is  
**characterized in that** the connecting element (3 and 3.1 to 3.4) consists entirely of thermoplastic synthetic material in the area of at least one anchoring position (31, 32), which can be plasticized at lower temperatures than the remainder of the connecting elements and that energy is supplied to the connecting element (3, and 3.1 to 3.4) in form of heat.
8. Process according to one of the claims 1 through 5 is  
**characterized in that** the connecting element (3 and 3.1 to 3.4) in area of at least one anchoring position (31, 33), has surface area of a thermoplastic material with embedded metallic particles and that the connecting element (3 and 3.1 to 3.4) is inductively heated for energy supply.
9. Process according to one of the claims 1 through 8 is  
**characterized in that** the part (1, 2.2) in which the

connecting element (3 and 3.1 to 3.3) is anchored consists of a wood-like material.

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10. Process according to one of the claims 1 through 8 is characterized in that the part (1, 2) in which the connecting element (3 and 3.1 to 3.3) is anchored, and consists of sandstone, of a porous ceramic material, or bricks, or concrete.

11. Process according to one of the claims 1 through 8 is characterized in that the part (1) in which the connecting element (3.4) is anchored, is a light construction element with cavities (11) and that the bore (4.4) is a continuous borehole through one external layer (1.1) which is closed to such degree by the inner layer (1.2) or by an element arranged in the cavity (11) that in the area of the closed end of the borehole (4.4) they are in essentially radial openings in the cavity areas (11.1) or are created by the force of pressure.

12. Connecting element (3 and 3.1 to 3.4) for use in the process according to claims 1 to 11, where the connecting

element has an internal side arranged against the closed end of the bore (4 and 4.1 to 4.4) arranged inner side and one of these at the opposite located external side is characterized in that the connecting element (3 and 3.1 to 3.4) shows on its inner side a first predetermined anchoring position (31) with has at least the surface areas of thermoplastic synthetic material as well as at an interval from the first anchoring position against the external side a second anchoring position (33) or on the external side a head-like enlargement (32) or mid-point (34) for attaching another part (6).

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13. Connecting element according to Claim 12 is characterized in that it is of pin type and a second anchoring position (33) has the form of a shoulder.

14. Connecting element according to Claim 12 is characterized in that it has an internal screw thread (33) for fastening another part (6).

15. Connecting element according to claims 12 through 14 is  
**characterized in that** it consists entirely of  
thermoplastic synthetic material.
16. Connecting element according to Claim 15 is **characterized**  
**in that** the thermoplastic synthetic material in the area  
of the predetermined anchoring position (31, 33) can be  
plasticized at lower temperature than the thermoplastic  
synthetic material in the other areas of the connecting  
element.
17. Connecting element according to claims 12 through 14 is  
**characterized in that** it consists of duroplast and, at the  
predetermined anchoring positions (31, 33) the surface  
areas are from thermoplastic synthetic material.
18. Connecting element according to claims 12 through 14 is  
**characterized in that** it has embedded metallic particles  
in the thermoplastic synthetic material in the area of the  
predetermined anchoring positions.
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19. Connecting element according to claims 12 through 18 is  
**characterized in that** it is a pin type and it is pointed at

its inner side or has a flat or concave face surface.

20. Connecting element according to claims 12 through 19 is characterized in that the thermoplastic synthetic material is a polyamide, a polycarbonate, or a polyester carbonate, or acrylo-nitrile butadiene styrene, styrene acryl nitrile, poly-methyl metacrylate, polyvinyl chloride, polyethylene, polypropylene or polystyrene.
21. Use of the process according to one of the claims 1 through 11 and one of the connecting elements according to one of the claims 12 through 20 for connecting individual parts of window frames or blinds of massive wood.
22. Use of the process according to one of the claims 1 through 11 and of a connecting element according to one of the claims 12 through 20 for attaching mountings on particle boards or light construction elements.

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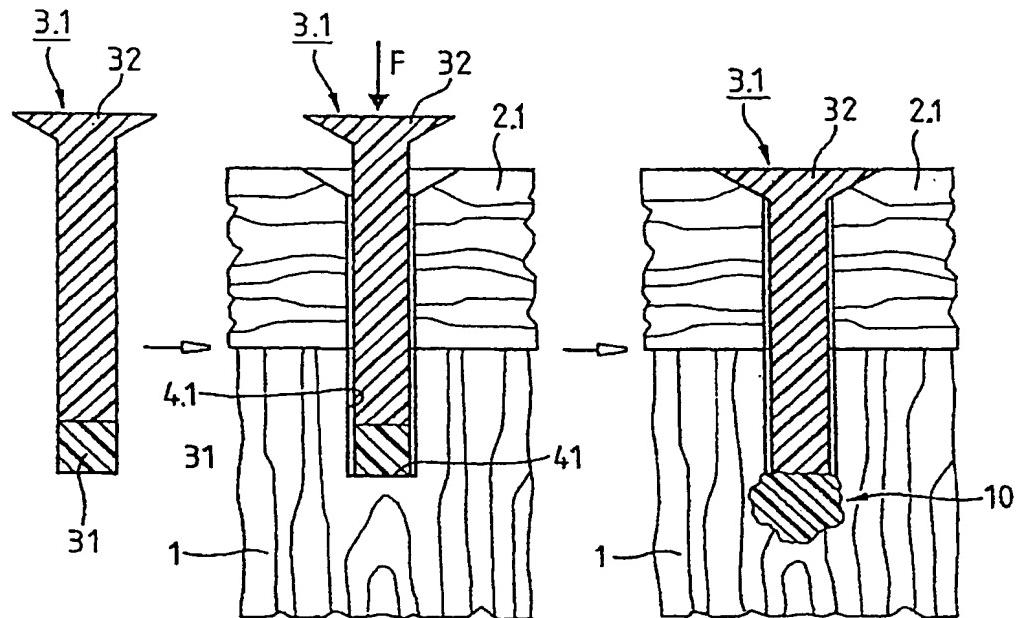


FIG. 1

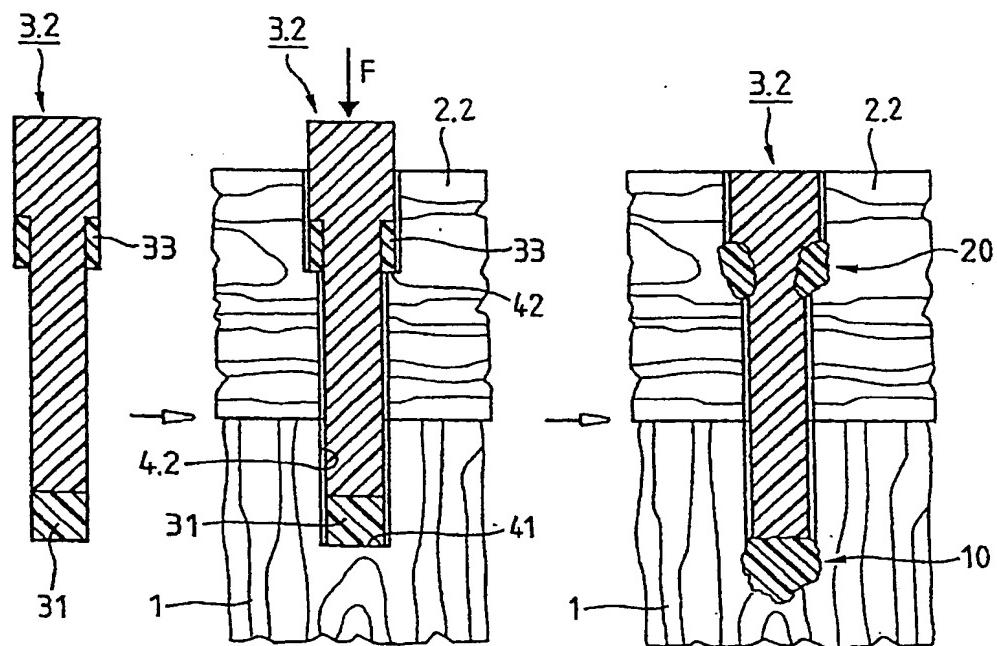
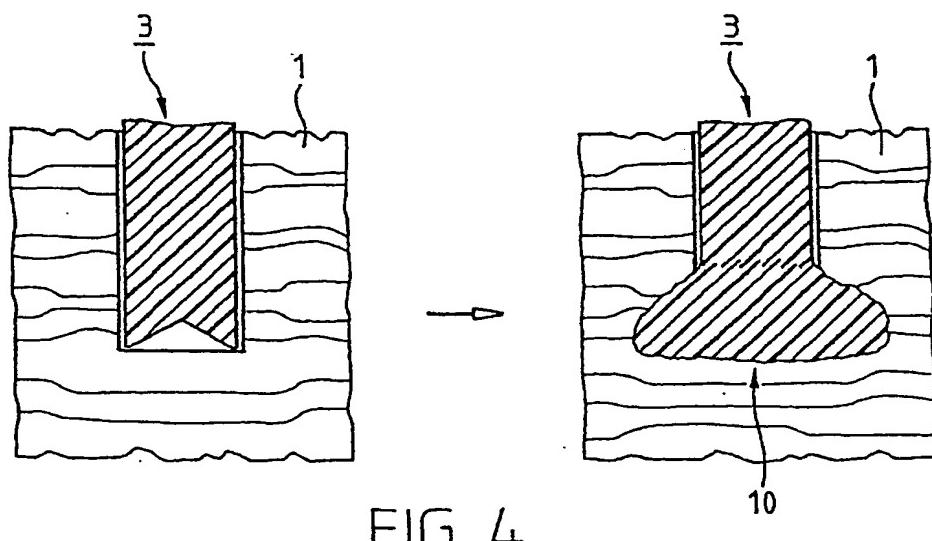
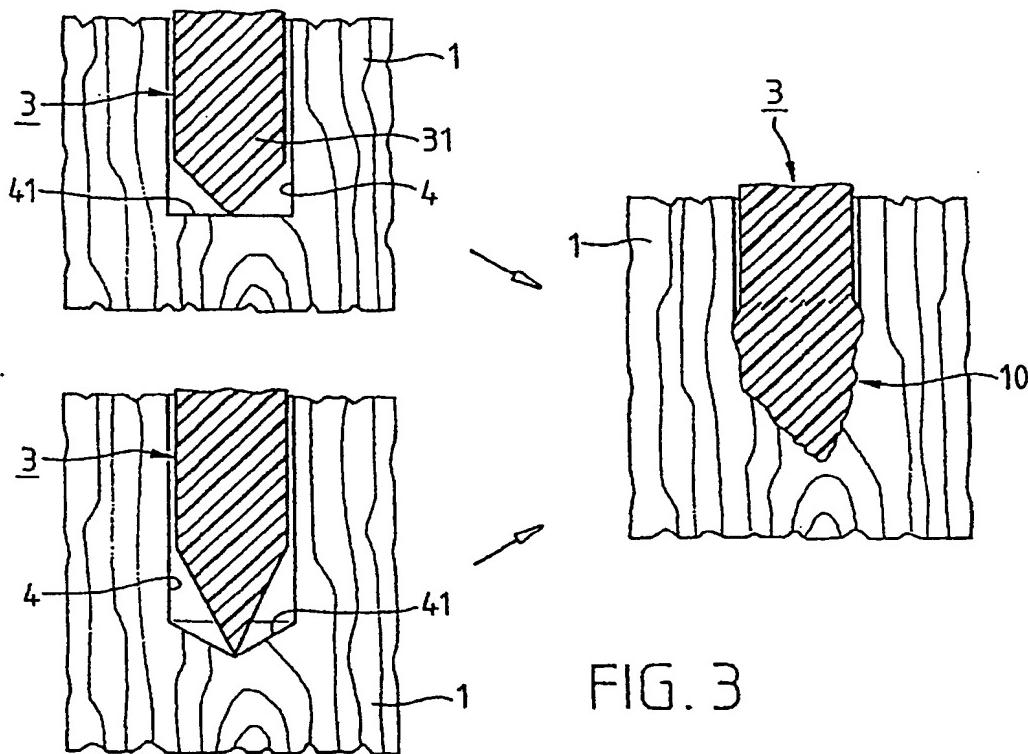


FIG. 2



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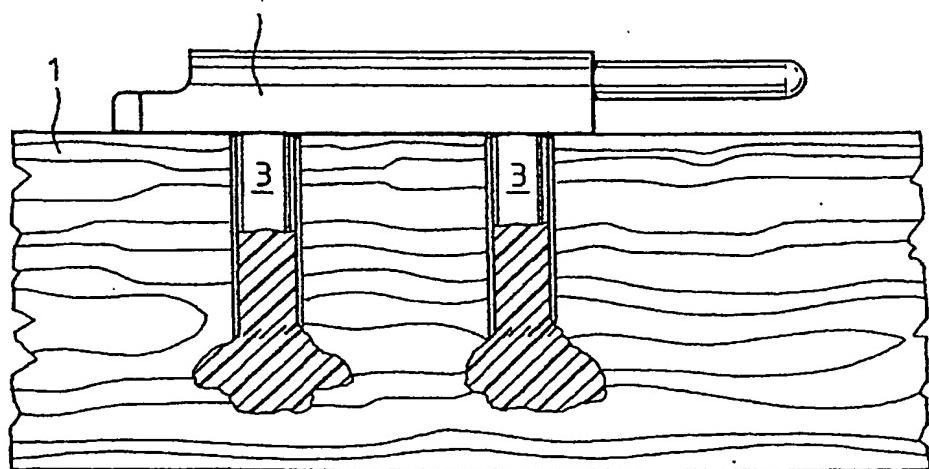
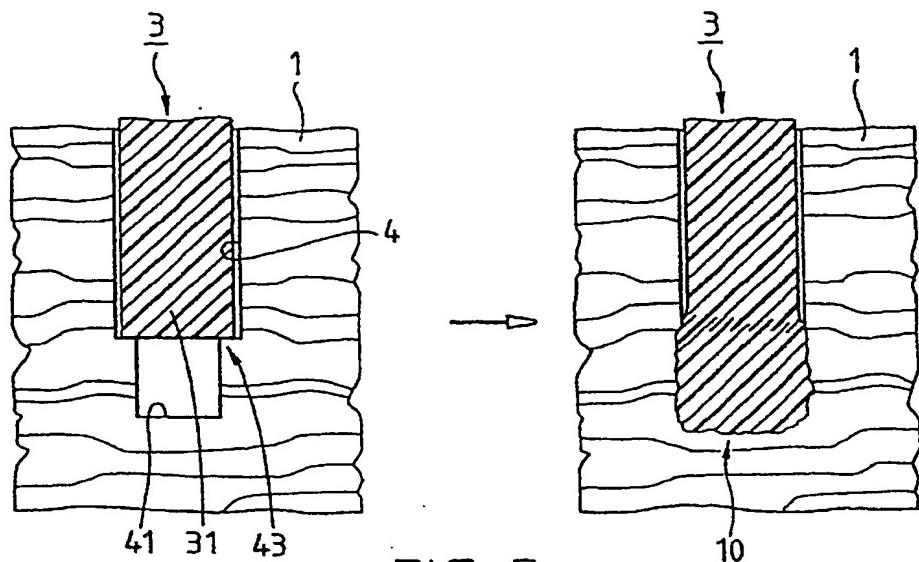


FIG. 6

FIG 7

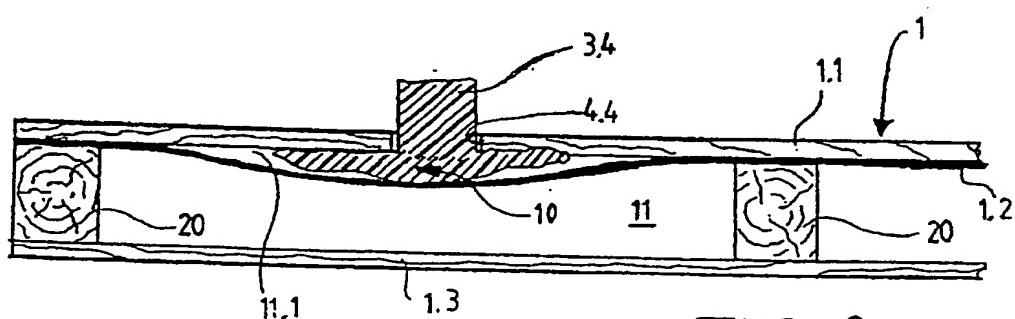
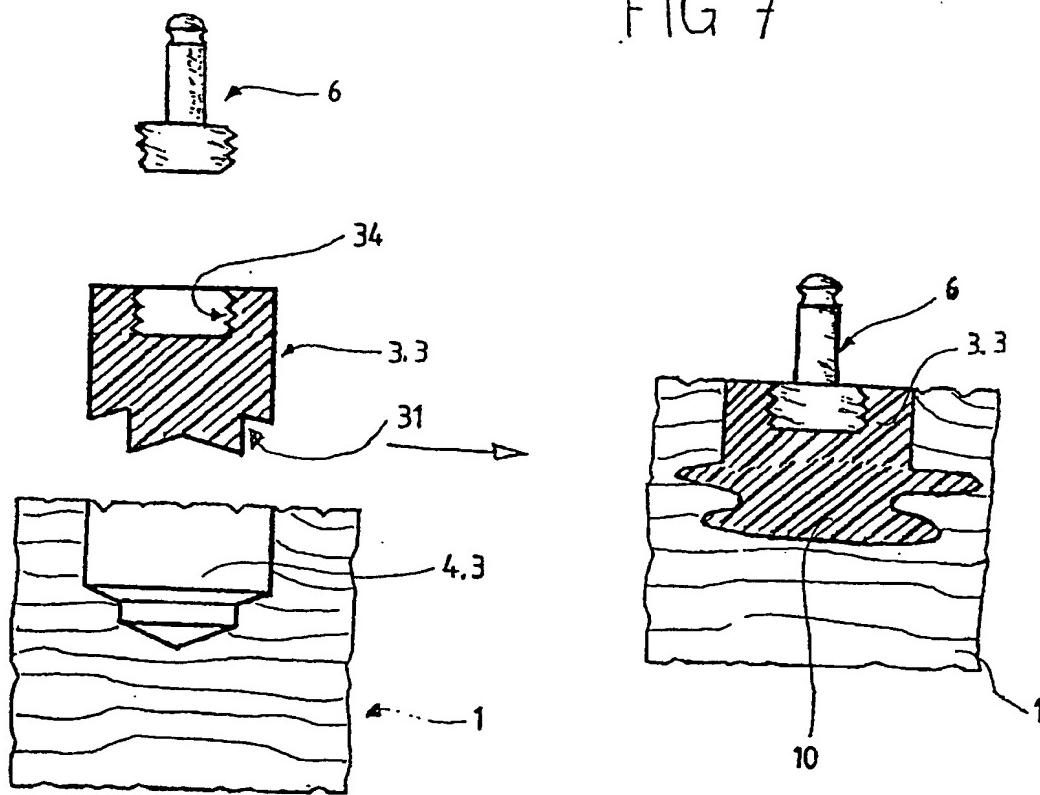


FIG 8

**INTERNATIONAL SEARCH REPORT**

International File No.

PCT / CH 98 / 00109

**A. CLASSIFICATION OF THE APPLICATION ITEM**

IPK 6 F16B13/00

According to the international patent classification [IPK] or according to national classification and the IPK

**B. SEARCHED FIELDS**

Searched minimum evidence material (classification system and classification symbols)

IPK 6 F16B B29C B27F

Searched publications which are not part of the minimum evidence to the extent that they fall under the searched fields

During the international search, the electronic data bank has been consulted (name of the data bank and possible used search terminology)

**C. DOCUMENTATION CONSIDERED TO BE ESSENTIAL**

Category*	Description of the publication, to the extent required in providing the parts coming under consideration	Concerns	Claim No.
X	WO 96 01377 A (CREATEC PATENT HOLDING; AESCHLIMANN MARCEL (CH); KOESTER HEINRICH) January 18, 1996	1, 2, 6, 9	
			10, 20-22

invention or the background theory.

"X" Publication of special significance; the claimed invention can be considered alone on basis of this publication not to be new or be assumed not to be based on innovation activity

"Y" Publication of special significance: the claimed invention cannot be considered to be based on innovation activity when the publication is brought in with one or several other publications of this category and this connections is obvious to an expert in the field

"&" Publication which is a member of the same patent family

Date of mailing of the international research report

07 / 06 / 1998

Responsible Official

Cordenier, J.

/Page 2 of 2

[Included in German and in an English translation]

/Unnumbered page

[INTERNATIONAL SEARCH REPORT included in German and in English]